

PROJECT FACT SHEET

CONTRACT TITLE: Research Program on Fractured Petroleum Reservoirs

DATE REVIEWED: 03/07/1995

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OBJECTIVE: The main objectives of this project are to develop a full understanding of the role of diffusive, capillary, gravity and viscous forces in the flow of fluids in fractured porous media. The plan is to conduct a comprehensive experimental and theoretical research program to better understand the basic mechanisms of oil recovery and recovery enhancement of fractured petroleum reservoirs.

ID NUMBER: DE-AC22-93BC14875

B & R CODE: AC1505/AC1510

CONTRACT PERFORMANCE PERIOD:

09/30/1993 to 09/29/1996

PROGRAM: Supporting Research

RESEARCH AREA: Extraction Research

DOE PROGRAM MANAGER:

NAME: Arthur M. Hartstein

COMMERCIAL: (301) 903-2760

CONTRACTOR: Reservoir Engineering
Research Institute

ADDR: 845 Page Mill Road

Palo Alto, CA 94304

CONTRACT PROJECT MANAGER:

NAME: Dr. Abbas Firoozabadi

ADDR: RERI

845 Page Mill Road

Palo Alto, CA 94304

PHONE: (415) 424-8833

FAX: (415) 424-9377

DOE PROJECT MANAGER:

NAME: Bob Lemmon

LOCATION: BPO

COMMERCIAL: (918) 337-4407

PROJECT SITE:

Palo Alto, CA

SCHEDULED MILESTONES:

FUNDING (1000'S)	DOE	OTHER	CONTRACTOR	TOTAL
PRIOR FISCAL YRS	115	727	0	842
FISCAL YR 1995	75	372	0	447
FUTURE FUNDS	0	0	0	0
TOTAL EST'D FUNDS	190	1,099	0	1,289

PROJECT DESCRIPTION: This project is divided into four tasks. Task 1 - Miscible Displacement in Fractured Porous Media studies miscible displacement in fractured porous media both experimentally and theoretically. Task 2 - Critical Gas Saturation, is divided into two subtasks; a) theoretical study of critical gas saturation, and b) visual measurements of gas evolution and flow in porous media. Task 3 - Immiscible Gas-Oil Gravity Drainage in Fractured/Layered porous media includes the theoretical and experimental study of immiscible gas-oil flow in both fractured and layered media by a unified approach. Task 4 - Water Injection in Fractured/Layered Porous Media, includes experimental and theoretical work; the experimental work includes water injection in fractured Austin Chalk cores and Berea sandstone matrix blocks.

PRESENT STATUS: The project is progressing on schedule

ACCOMPLISHMENTS: Several important issues related to gas oil displacement in fractured petroleum reservoirs have resolved as a result of our work.

1. Oil flows mainly in the matrix in the two phase region. This point has been demonstrated experimentally and theoretically.
2. The flow of oil from one matrix to another is through liquid bridges in the fractures. Significant recovery enhancement could be achieved by a 50 percent reduction in gas oil surface tension. Fundamental theoretical work is the basis of our understanding.
3. Miscible displacement in fractured porous media is much more efficient than the general belief based on current literature models. The crossflow between the matrix and fracture is very pronounced. Our experimental and theoretical work support this conclusion.
4. In solution gas-drive, the formation of a new gas phase below the bubblepoint pressure is an instantaneous nucleation process. We have established this point both theoretically and experimentally. The nature of gas phase evolution has revealed that in fractured light oil reservoirs, solution gas-drive is not efficient, whereas in fractured heavy oil reservoirs solution-gas driven might be very efficient.
5. A numerical model which incorporates the concepts of capillary continuity and reinfiltration has been developed.
6. Experimental results have revealed that capillary imbibition could lead to efficient displacement of oil by water in tight matrix blocks with a permeability of less than 0.01 md.

Some thirty papers (mostly SPE publications) have been written from the work of this research program.

BACKGROUND: The mechanisms of fluid transfer between matrix blocks and fractures and the interaction of matrix blocks for immiscible and miscible flow are not well understood. Consequently, complicated numerical models currently in use cannot yield reliable results. A key element to recovery enhancement of fracture petroleum reservoirs and the use of models to simulate those reservoirs is an adequate knowledge of multiphase flow in fractured porous media.